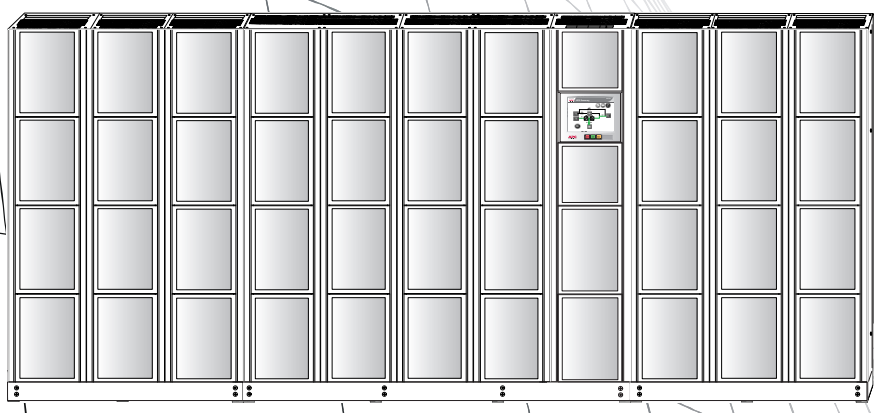
APC
by Schneider Electric

Installation

Symmetra®
MW II

1200 kW
400 V



Contents

Safety

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

This guide contains important instructions for SYMF1200KH that should be followed when handling the UPS, External Bypass Static Switch, Battery Enclosures, and Batteries.

Symbols used in this guide

Warning: Indicates an electrical hazard, which, if not avoided, could result in injury or death.

Caution: Indicates a hazard, which, if not avoided, could result in injury or death.

Note: Indicates important information.

Indicates that more information is available on the subject.

Main Protective Earthing Terminal symbol.

Ground symbol.

Installation safety

EPO

Press the optional EPO (Emergency Power Off) button to switch off all AC and DC power supply to connected equipment in the room and to cut off the load supply. The EPO is typically located on a wall in the room in which the UPS is installed. See “Communication cable overview” section for information on how to wire the UPS to the EPO.

Warning: Before you start the installation, verify that all AC and DC power source breakers are in the open position.

Warning: Only personnel trained in the construction and operation of the equipment, and the electrical and mechanical hazards involved, must install or remove system components.

Warning: Do not use high voltage testing equipment as it will destroy the electronic circuits in the units.

Caution: The system is equipped with an optional auto-start function enabling the system to start without any warning when power is applied.

Caution: All wiring to be in accordance with applicable national and/or local electrical wiring rules.

This unit contains components that are sensitive to electrostatic discharge (ESD). Follow proper ESD procedures to avoid severe damage to electronic components.

System Overview

UPS Sections

The UPS system consists of two 600 kW Inverter Sections, a Control/Input/Output Section and an External Bypass Static Switch Section.

Serial number

The serial number is stated on the type label behind the finishing panel above the display unit. Remove finishing panel as described in “Appendix C” to see serial number.

Inverter Section

The Inverter Sections regulate the UPS output and operates from battery power in the event of mains input loss.

Control/Input/Output Section

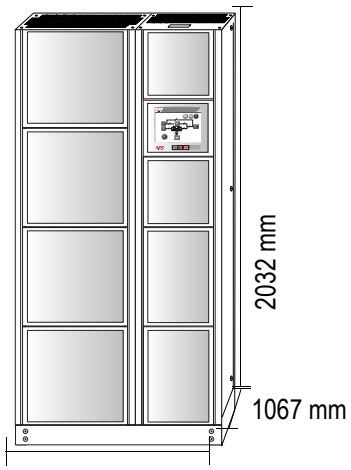
The Control/Input/Output Section controls and monitors the UPS and contains the input/output terminations.

Total width of UPS sections:
4646 mm

Weight:
Without Power Modules: 5301kg
With Power Modules: 6324 kg

External Bypass Static Switch

The External Bypass Static Switch (External Bypass SSW) transfers the load (manually or automatically) from the UPS to an alternate source without interrupting the supply to the load.



2 MW External Bypass Static Switch

Width:
1014 mm

Weight:
636 kg

Serial number

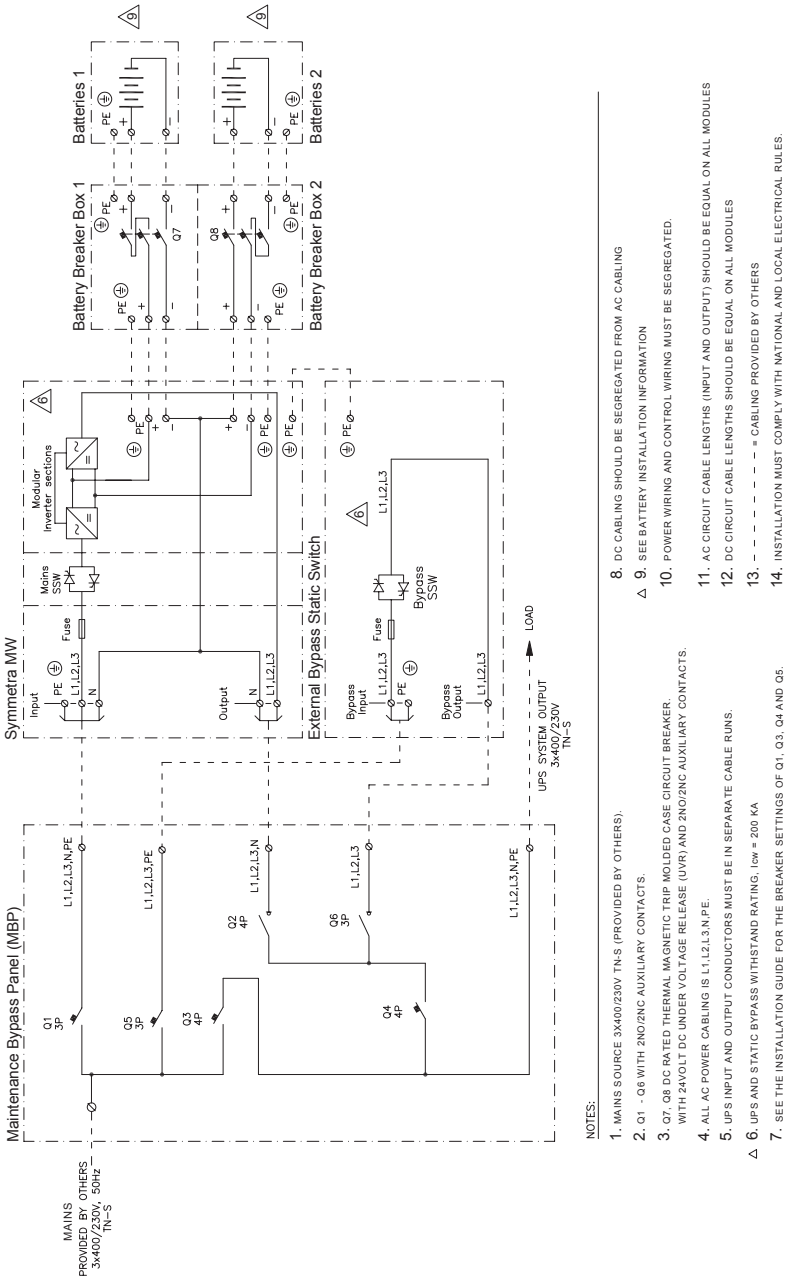
The serial number is stated on the type label behind the finishing panel above the display unit. Remove finishing panel to see serial number.

Electrical Installation

Typical UPS Wiring Principle

Power wiring overview

See separate guide on parallel operation for wiring overview in parallel systems.



External disconnection switches

Warning: The UPS has no built-in disconnect devices to switch off external AC (Q1 and Q5) and DC (Q7 and Q8) input power. Ensure that the disconnect devices are available as separate components for this installation.

Note: The installer must provide each external disconnect device for this UPS system with labels displaying the following text: “Isolate the Uninterruptible Power Supply (UPS) as instructed in the User Guide before working on the circuit.”

Input/Output wiring precautions

Warning: Only personnel trained in the construction and operation of the equipment, and the electrical and mechanical hazards involved, must install or remove system components.

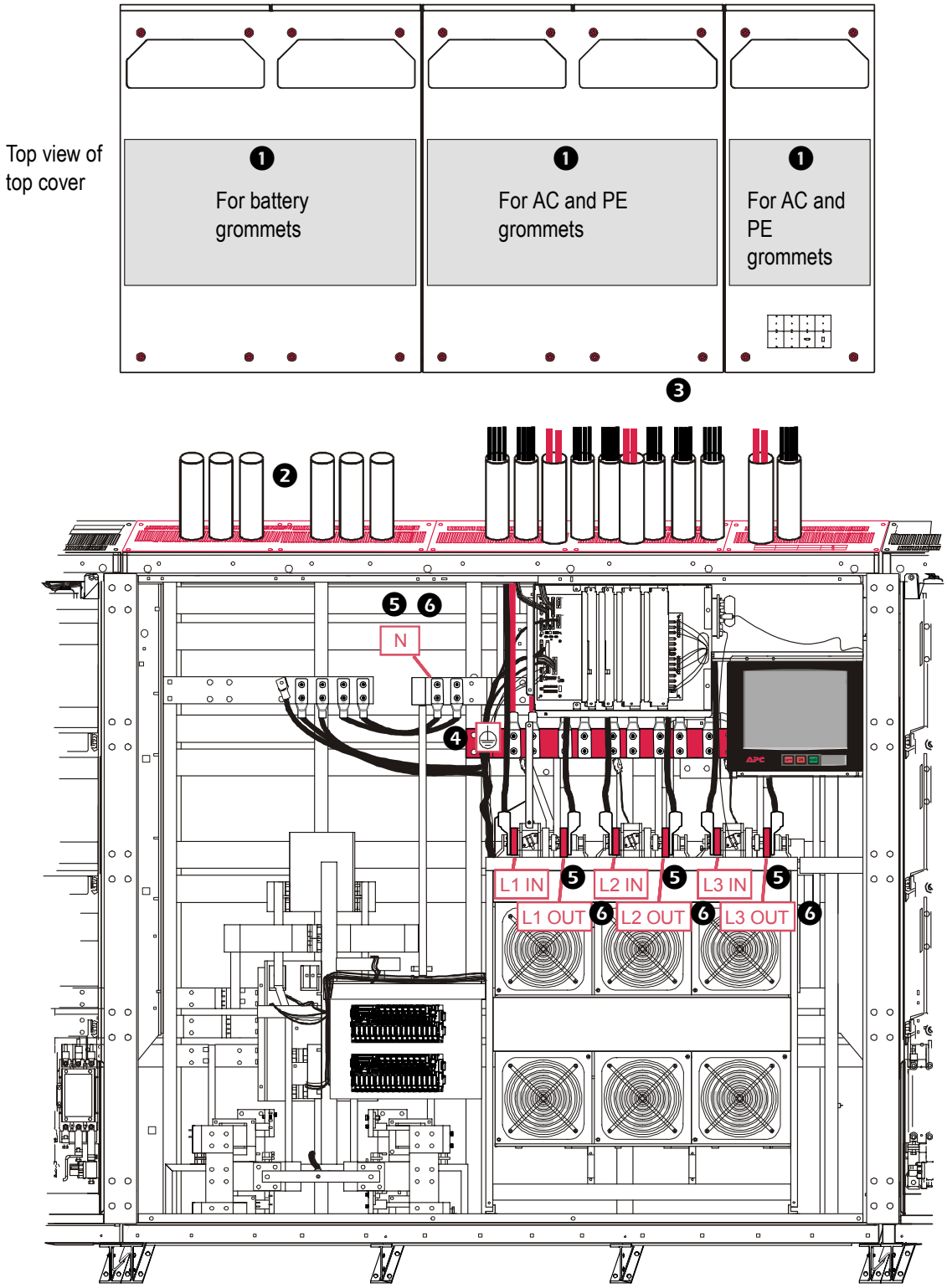
Warning: Before you start the installation, verify that all AC and DC power source breakers are in the open position.

Warning: Supply the UPS from a 3 × 400/230 V, L1, L2, L3, N, PE source or a high-impedance grounded system.

Caution: All wiring to be in accordance with applicable national and/or local electrical wiring rules.

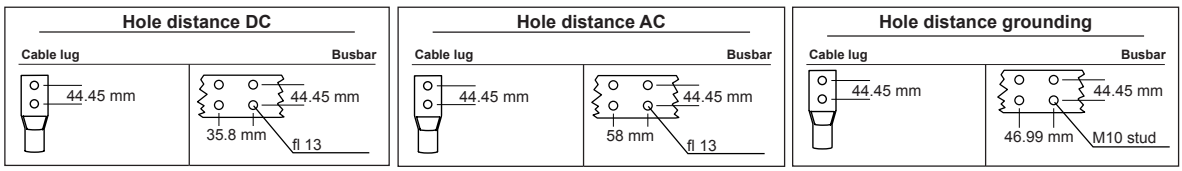
Note: Use only copper conductors.

AC and PE cable connections



Note: No drilling or cutting should take place over the top of the UPS.

1. With the top covers removed, drill holes for AC, PE and Battery grommets in areas shown.
2. Re-fit the covers and install the grommets.
3. Feed AC and PE cables through grommets in the Control/Input/Output Section.



4. Connect PE cable.
5. Connect AC IN cables to normal power and bypass power.
6. Connect AC OUT cables.

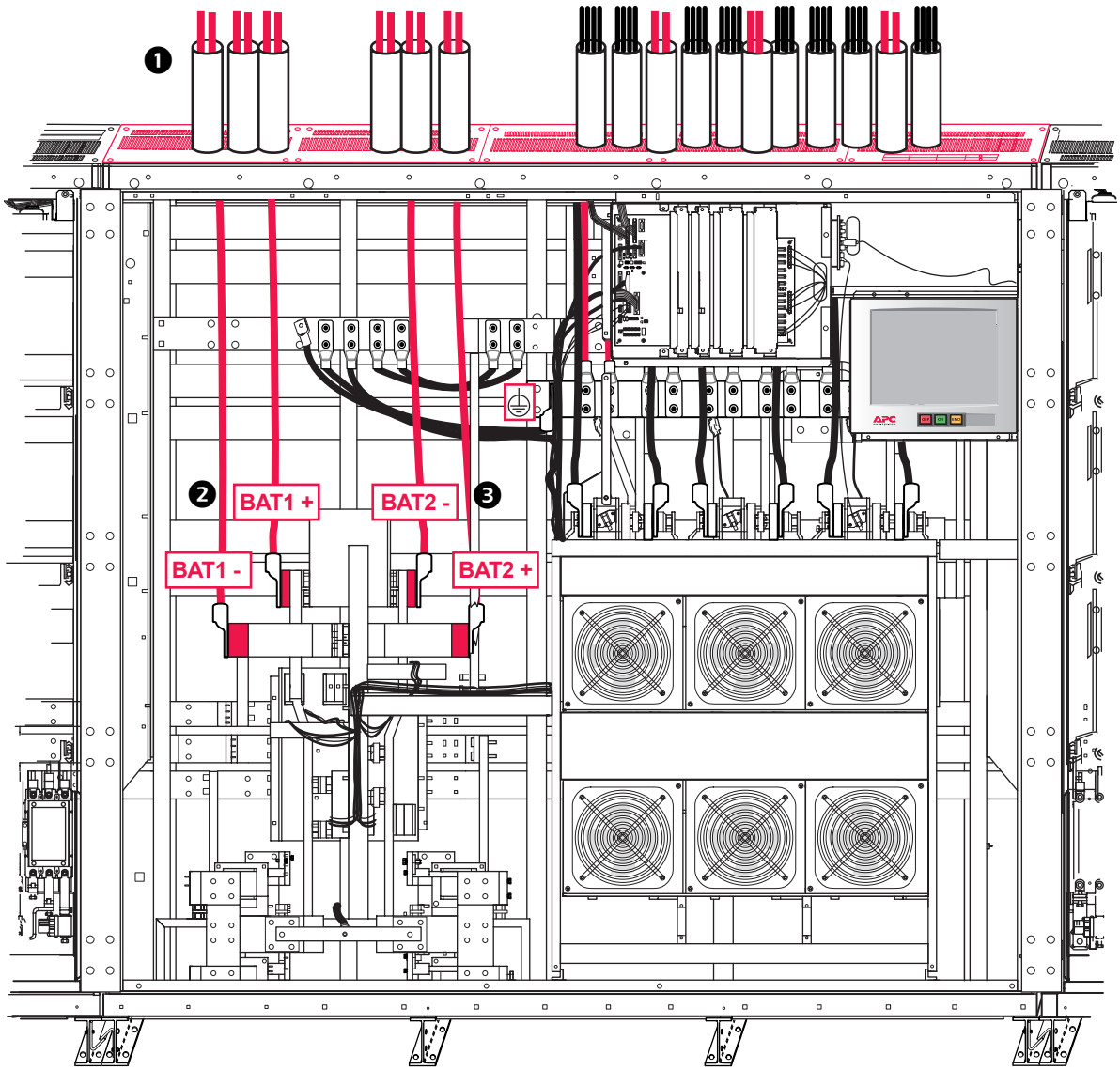
Battery cables connection

Warning: Make sure that the battery breakers are open (OFF) prior to running the cables.

Caution: For battery installation and maintenance instructions, refer to the battery manufacturer's installation manual.

Caution: Over-current protection for the battery circuit is required by code. The minimum DC voltage rating of the battery supply over-current protection device is 500 V.

Note: Over-current protection for the battery circuit is required by national wiring rules.



1. Feed the battery cables through the grommets.
2. Connect battery cables to Bat 1+ and Bat 1-.
3. Connect battery cables to Bat 2+ and Bat 2-.

Note: The battery cables can be connected on either side of the busbar.

External Bypass Static Switch Wiring

Warning: Before you start the installation, verify that all AC and DC power source breakers are in the open position.

Warning: Use only manual reset protection as input over-current protection.

Warning: Over-current protection required by national wiring rules.

Warning: The UPS has no built-in disconnect devices to switch off external AC (Q1 and Q5) and DC (Q7 and Q8) input power. Ensure that the disconnect devices are available as separate components for this installation.

Caution: The External Bypass Static is not provided with built-in backfeed protection. Use suitable breakers with a minimum of 0.8 in/20 mm air gap and trip function. The breaker is controlled from the External Bypass SSW and will be tripped in case of backfeed.

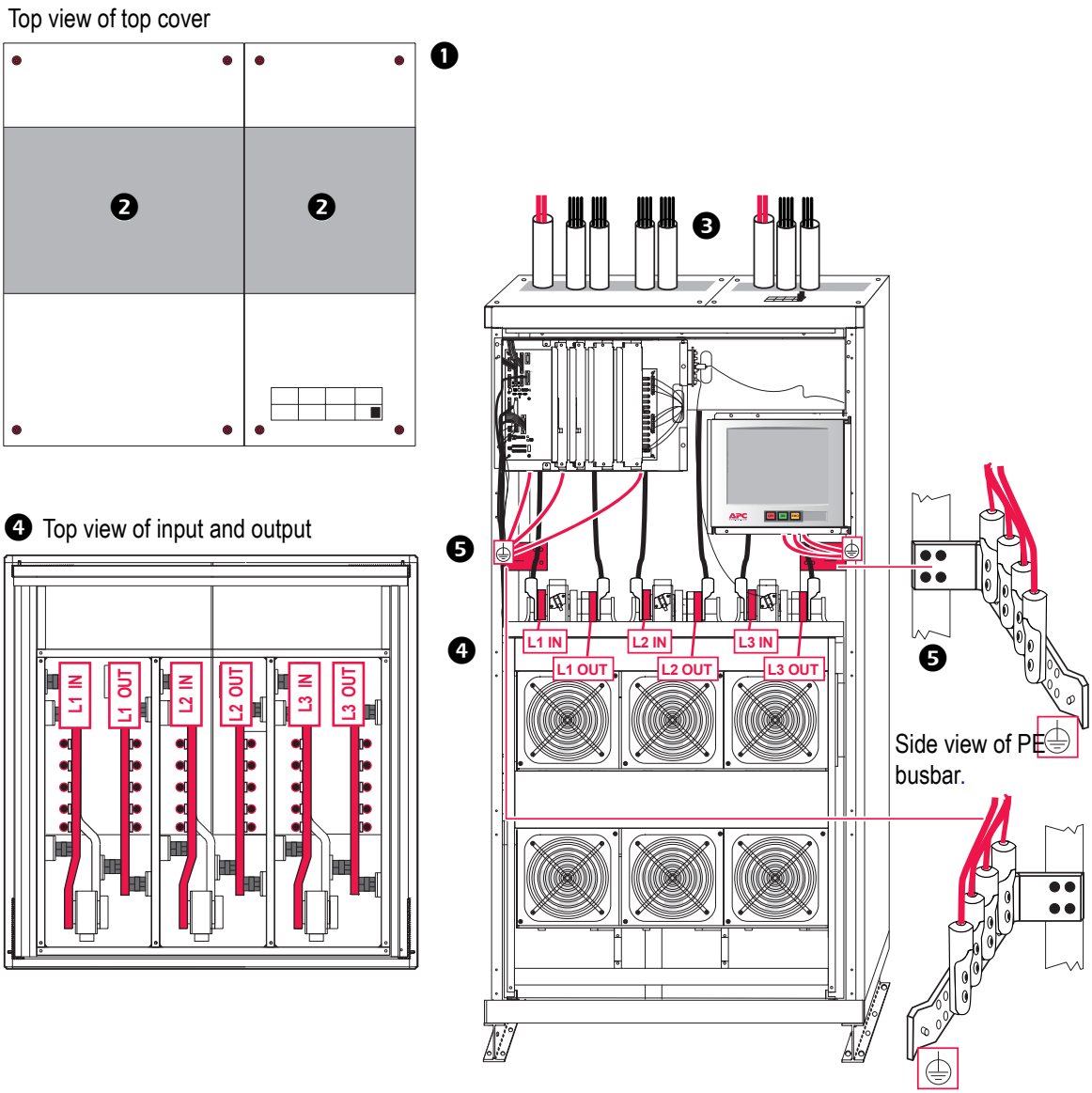
Note: The installer must provide each external disconnect device for this UPS system with labels displaying the following text: “Isolate the Uninterruptible Power Supply (UPS) as instructed in the User Guide before working on the circuit.”

Note: The installation of the External Bypass Static Switch must comply with local and national regulations.

Note: Run matched set of phase cables in the same cable run(s). Do not separate phases into different cable runs.

Note: Use only copper conductors.

Top cable entry

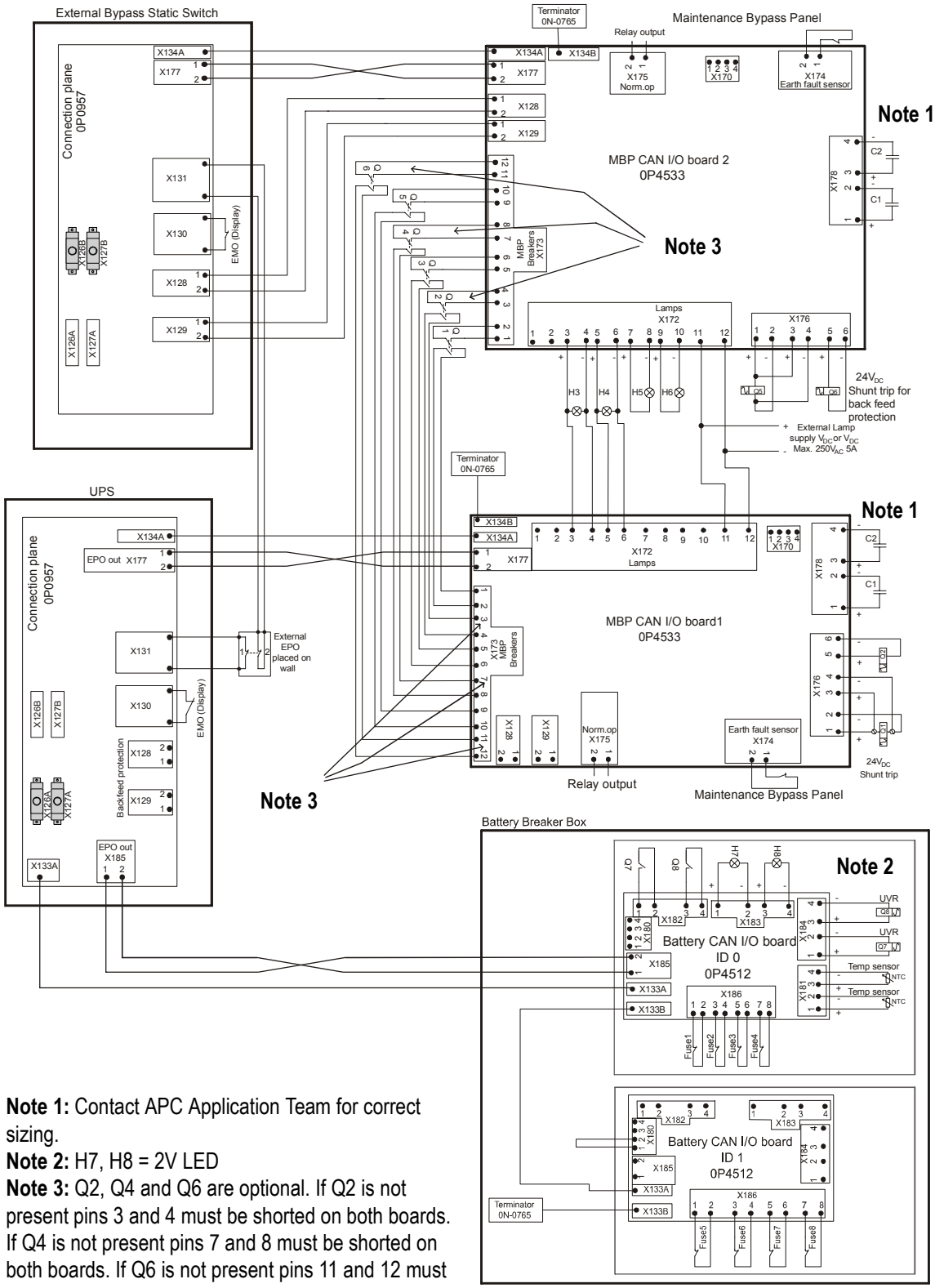


1. Loosen the 8 bolts to remove top cover.

Note: No drilling or cutting should take place over the top of the UPS.

2. Drill holes for grommets.
3. Re-fit the covers and install the grommets.
4. Feed the cables through the grommets. Connect cables at cable connection points.
5. Connect Protective Earth conductor to busbar locations.

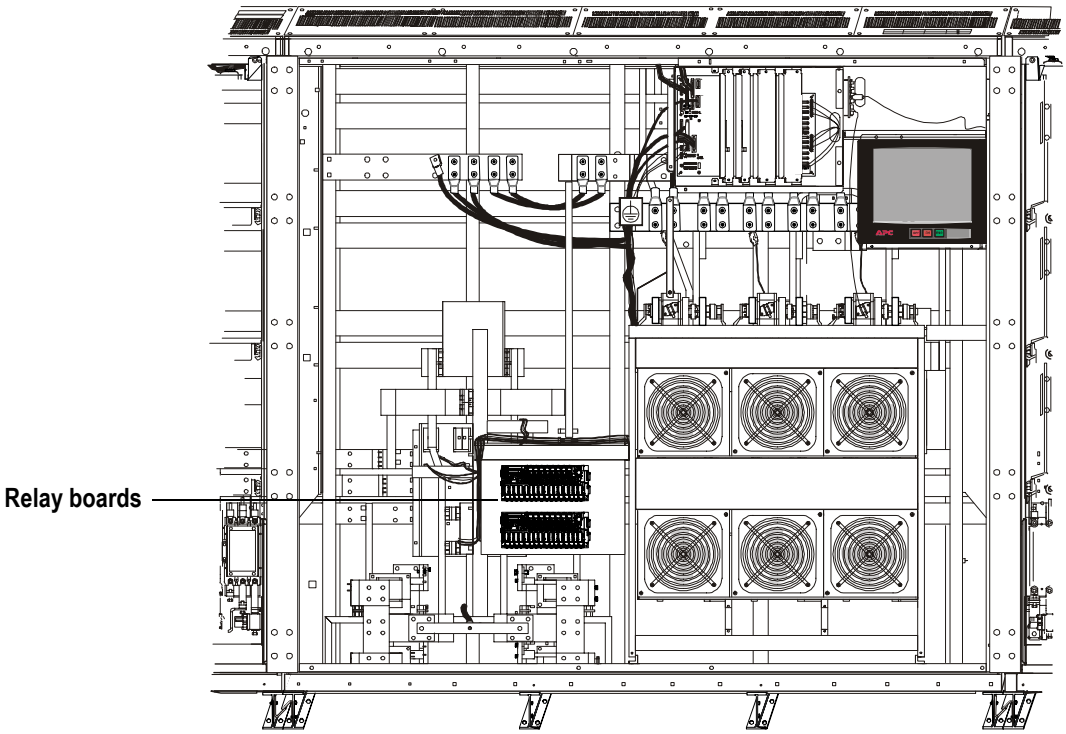
Communication cable overview



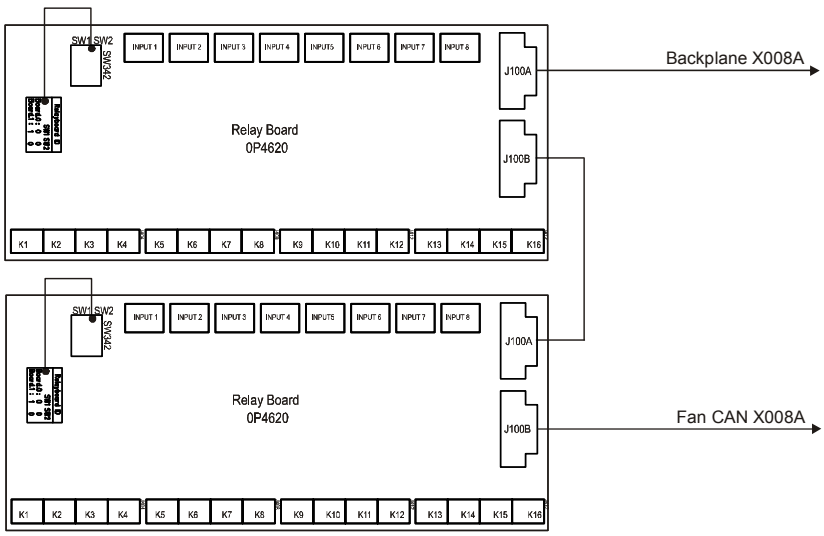
Note 1: Contact APC Application Team for correct sizing.
Note 2: H7, H8 = 2V LED
Note 3: Q2, Q4 and Q6 are optional. If Q2 is not present pins 3 and 4 must be shorted on both boards. If Q4 is not present pins 7 and 8 must be shorted on both boards. If Q6 is not present pins 11 and 12 must be shorted on both boards.

Relay Boards

Location of relay boards



Communication cables with optional Relay Board



Relay board 1 connections

Relay	Function	Mode	Special	Comments
Output 1	Common alarm	Fail safe		
Output 2	Normal operation	Active on		
Output 3	Bypass operation	Active on		
Output 4	Battery operation	Active on		
Output 5	V_{DC} out of tolerance	Fail safe		
Output 6	Battery conditon fault	Fail safe		Battery fault detected by battery monitor
Output 7	Maintenance bypass operation	Active on		
Output 8	Mains out of tolerance	Fail safe		
Output 9	Bypass out of tolerance	Fail safe		
Output 10	Output out of tolerance	Fail safe		
Output 11	MCCB open	Fail safe		Battery breakers open
Output 12	System overload	Fail safe		
Output 13	Good utility	Active on		If UPS goes into bypass, this relay goes on without delay
Output 14	Boost charge active	Fail safe		
Output 15	Fan fault	Fail safe		
Output 16	Temperature fault	Fail safe		Temperature switch active or faulty temperature sensor
Input 1	Generator active		Master will handle signal	Input for indicating that a generator is active. This will be used to reduce the charge power
Input 2	Battery room ventilation fault		Individual	Input for indicating that the ventilation in battery rooms is defect. This will be used to reduce the charge power
Input 3	DC Ground Fault Detection		Individual	
Input 4	Reserved for future use		Master will handle signal	
Input 5	Plant clock synchronization		Master will handle signal	Input for real time clock synchronization
Input 6	Power Tie detection		Master will handle signal	Input from PLC to detect if Power Tie is active

Relay	Function	Mode	Special	Comments
Input 7	Reserved for future use			
Input 8	Reserved for future use			

Relay board 2 connections

Relay	Function	Mode	Special	Comments
Output 1	Info level alarm	Fail safe		
Output 2	Warning level alarm	Fail safe		
Output 3	Severe level alarm	Fail safe		
Output 4	Input frequency too high	Fail safe		
Output 5	Input frequency too low	Fail safe		
Output 6	Output frequency too high	Fail safe		
Output 7	Output frequency too low	Fail safe		
Output 8	Bypass source fault	Fail safe		
Output 9	Close Q7 pulse	Active on	No delay	
Output 10	Close Q8 pulse	Active on	No delay	
Output 11	Power Tie mode active	Active on	No delay	
Output 12	Close Q2	Fail safe	No delay	
Output 13	Reserved for future use			
Output 14	Reserved for future use			
Output 15	Reserved for future use			
Output 16	Reserved for future use			
Input 1	Reserved for future use			
Input 2	Reserved for future use			
Input 3	Reserved for future use			
Input 4	Reserved for future use			
Input 5	Reserved for future use			
Input 6	Reserved for future use			
Input 7	Reserved for future use			
Input 8	Reserved for future use			

Specifications

Low-Impedance/High-Impedance Earthing

The Symmetra® MW is easily integrated into either a solid grounded system, or a high-impedance grounded system.

In a solid grounded system, the neutral power source (mains, generator, or UPS) is solidly grounded. In the event of a down-stream ground fault, the fault current will have a path back to the source, and the over-current device feeding the faulted part of the installation will trip and isolate the fault.

In a high-impedance grounded system, the source is grounded with an impedance (grounding resistor). In the event of a down-stream fault, the fault current will be limited by the impedance of the grounding resistor. The value of a high-impedance system is its ability to maintain operation with a given system fault to ground, i.e. the over-current device will only trip at line-to-line faults or double ground faults. For a high-impedance system to provide enhanced power system reliability and availability, a ground-fault monitoring/alarm system is required.

Note: Grounding electrode conductor to be supplied by the customer.

For more information refer to “Appendix” in Installation Guide.

Electrical Specifications

Warning: Supply the UPS from a dedicated, 3 × 400/230 V, L1, L2, L3, N, PE source or a high-impedance grounded system.

Caution: Ensure clockwise phase rotation (L1, L2, L3) of input voltages.

Caution: AC and DC disconnect switches and overcurent protection must be included in the installation.

Note: All wiring must comply with all applicable national and/or local electrical codes.

Note: Max. prospective RMS short-circuit current on input terminals: 200 kA
Max. prospective RMS short-circuit current on DC terminals: 50 kA

AC Input

AC Input	
Input rating	1200 kW/kVA
Power Factor	1
Input Voltage	**380 V**
Input Frequency	50 Hz
Nominal input current (note 1)	1698 A
Input Current Limitation (note 2)	2133 A
Input Voltage	**400 V**
Input Frequency	50 Hz
Nominal input current (note 1)	1793 A
Input Current Limitation (note 2)	2200 A
Input Voltage	**415 V**
Input Frequency	50 Hz
Nominal input current (note 1)	1728 A
Input Current Limitation (note 2)	2170 A

DC Input

DC Input	
Nominal Voltage (note 3)	2 x 384 V
I_{Nom} Discharge (note 4)	1628 A
I_{Max} Discharge (note 5)	1929 A

Caution: Over-current protection for the battery circuit is required by code. The minimum DC voltage rating of the battery supply over-current protection device is 500 V.

AC Output

AC Output	
Voltage	**380 V**
Current Nom (note 8)	1641 A
Max (note 7)	2051 A
Voltage	**400 V**
Current Nom	1732 A
Max (note 7)	2165 A
Voltage	**415 V**
Current Nom	1669 A
Max (note 7)	2087 A

AC Input External Bypass SSW

The External Bypass SSW is designed to accommodate a continuous overload of 25%.

AC Input External Bypass SSW	
External Bypass SSW Max Input Current (100% load)	
380 V	1641 A
400 V	1732 A
415 V	1669 A

Heat dissipation

37.1 kW / 126.7 kBTU/hr (note 6).

Notes

1. Nominal (Nom): Input current based on rated load, nominal input voltage and fully charged batteries.
2. Current limitation is maximum allowed via electronic current limiting and is based on full battery recharge + nominal load and -10% input voltage.
3. Nominal battery voltage assumed to be 2.0 volts/cell (lead technology).
4. Nominal Battery Discharge current based on rated load, and nominal Battery voltage.
5. Maximum Battery Discharge current based on rated load at end of Discharge.
6. Heat dissipation calculated at rated load capacity.
7. This current is at 125% of rated load and is electronically current-limited to a maximum of 10 minutes. This value is only provided so the engineer can ensure that the selected AC output circuit overcurrent device’s time-current characteristic will support this condition.
8. At 380 V, nominal output is reduced from 200 kW to 180 kW in each section.

Torque specifications

Torque specifications	
Bolt Size M8	13.5 Nm
Bolt Size M10	30 Nm
Bolt Size M12	50 Nm
Bolt Size M14	75 Nm

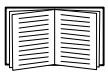
Required Breaker Settings (400 V Systems)

Note: Contact APC Application Team for Required Breaker Settings in 380 V and 415 V systems.

The Symmetra® MW is a fault-tolerant system capable of handling and surviving overloads and internal/external faults. The overload performances and fault clearings are possible when the system meets specified minimum requirements for breaker settings.

A proper breaker coordination study is required to ensure the highest availability of the UPS. This breaker coordination study should be performed focusing on maintaining the fault tolerant characteristics of the Symmetra MW.

The following tables provide the optimum settings for the input and output breakers. The settings are specified in the tables below, but some of them can also be found in the Electrical Specification section.



See separate manual on parallel operation for information on required breaker settings in parallel systems.

Input and upstream breakers

Q1, Q5, and any upstream breaker			
Duration [S]	**Current [A]**	**Total load [%]**	**Event/Operation**
≤ 0.005	22 kA	--	Internal fault clearing
∞	2200*	127	Overload on-line
∞	1793	100	On-line
∞	1972	110	On-line+ Max. Battery charge
*** In the absence if a coordination study conducted by a professional engineer, the recommended instantaneous trip setting for breakers Q1, Q2, Q4, Q5, and Q6 is 22 kA ** Only applicable to Q1**			

Output and downstream breakers

Q2, Q4, Q6			
Duration [S]	**Current [A]**	**Total load [%]**	**Event/Operation**
≤ 0.005	22 kA	--	Internal fault clearing.
60	3464*	200	Overload on-line
600	2165*	125	Overload on-line
∞	1732	100	On-line
*** In the absence if a coordination study conducted by a professional engineer, the recommended instantaneous trip setting for breakers Q1, Q2, Q4, Q5, and Q6 is 22 kA ** Only applicable to Q2 and Q4**			

In the absence of a proper breaker coordination study and if only the actual Ip on the unit's input terminals is known, this table must be used to optimize the instantaneous trip setting or to choose a breaker with a usable fixed instantaneous trip value.

Ip* [kA]	I peak let-through [kA]	I setting [kA]
200	16	18
140	14	16
100	13	15
50	10.5	12
30	9	11
*** Ip = Abridgment for Prospective short-circuit current. This is the current that would flow in the fault circuit is the fuse was replaced by a link with an infinitely small impedance**		

22 kA is the maximum peak let-through current (including safety factor) present during clearing of an internal fault in a 200 kW section or a power module. This maximum peak let-through current is based on and applicable to utility with prospective short-circuit currents (Ip) up to 200 kA.During or after a controlled fault clearing, none of the breakers are allowed to trip on the instantaneous trip setting below the specified value. This is also applicable to the upstream breakers, and a check of the instantaneous trip setting in this part of the installation is required.

The instantaneous trip setting calculated by a professional engineer in a breaker coordination study must not disable the functionality of clearing and surviving an internal fault unless there is a written agreement between APC by Schneider Electric and the customer.

By ensuring the unit's fault clearing ability (survival skills) i.e. using the correct instantaneous trip settings in the switch gear (installation), maximum power availability in normal operation is obtained for the critical load.

Note: The instantaneous trip setting can be calculated when utility Ip is known. An incorrect trip setting can result in limiting the system functionality and jeopardize the load support.

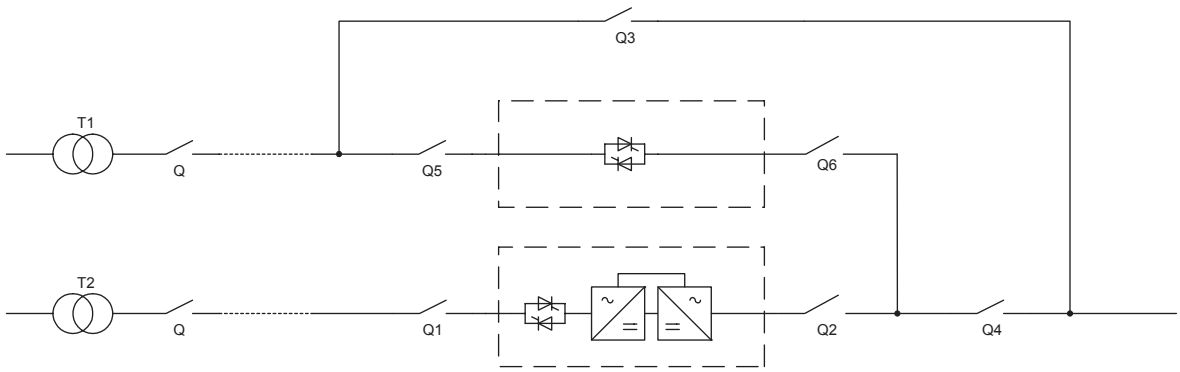
Note: The instantaneous trip setting must not be derated even though the UPS system is derated in system output power. The system size has no influence on the instantaneous trip setting.

Note: For derated systems, the APC Application Team can provide the correct breaker settings and breaker frame sizes.

Note: For upstream breakers not mentioned in the table, the APC Application Team can provide the correct breaker settings for on-line, overload, and trip currents.

The following diagram shows a dual mains system in which the upstream breakers are named Q. Correct settings of upstream breaker settings are mandatory. The system can also be configured as a single mains system.

Dual Mains Installation



Appendix

System and Protective Earthing

The purpose of this appendix is to describe the system- and protective earthing principles of the Symmetra® MW.

Caution: All wiring to be in accordance with applicable national and/or local electrical wiring rules.

TN Systems

Characteristics

TN systems have one point connected directly to ground. All exposed conductive parts must be connected to that point by protective conductors.

Depending on the way the neutral and protective conductors are fed, there are three types of TN systems:

- TN-S system: a separate protective conductor is used in the system
- TN-C-S system: the neutral and protective conductors are combined to one single conductor in a part of the system
- TN-C system: the neutral and protective conductors are combined to one single conductor in the whole system

Reference to IEC 60364-4-41 413.1.3

All exposed conductive parts of the installation must be connected to the earthed point of the power system by protective conductors which must be earthed at or near to each relevant transformer or generator.

Exposed conductive parts that are accessible at the same time must be connected to the same earthing system, either individually, in groups or collectively.

Normally the earthed point of the power system is the neutral point. If a neutral point is not available or accessible, a phase conductor must be earthed. The phase conductor must not serve as a PEN conductor.

In fixed installations a single conductor may serve both as a protective conductor and a neutral conductor (PEN conductor).

Reference to IEC 60364-5-54 546.2.3

If from any point in the installation the neutral and protective functions are provided by separate conductors, it is inadmissible to connect these conductors to each other from that point. At the point of separation, separate terminals or bars must be provided for the protective and neutral conductors. The PEN conductor must be connected to the terminal or bar intended for the protective conductor.

If there are other effective earth connections, the protective conductors must be connected to such points when it is possible. It may be necessary to earth at additional points to ensure that the potentials of protective conductors remain as close as possible to that of earth in case of a fault.

Additional requirements for generating sets (IEC 60364-5-55 551.4.2)

To be used when the generating set provides a switched alternative to the public supply.

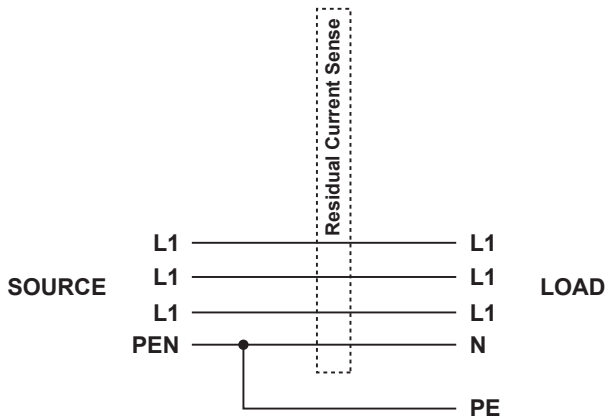
Protection by automatic disconnection of supply must not rely on the connection to the earthed points of the public supply system when the generator is operating as a switched alternative to a TN system. A suitable earth electrode must be provided.

Protective devices in TN systems

The following protective devices are recognized in TN systems:

- Overcurrent protective devices
- Residual current protective devices (not to be used in TN-C systems)

When a residual current protective device is used in a TN-C-S system, a PEN conductor must not be used on the load side. The connection of the protective conductor to the PEN conductor must be made on the source side of the residual current protective device (see below illustration):



The characteristics of protective devices and the circuit impedances shall be such that, if a fault of negligible impedance occurs anywhere in the installation between a phase conductor and a protective conductor or exposed conductive part, automatic disconnection of the supply will occur within 5 seconds (valid for distribution circuits), the following condition fulfilling this requirement:

$$Z_s \times I_a \leq U_0$$

In the condition:

Z_s is the impedance of the fault loop comprising the source, the live conductor up to the point of the fault, and the protective conductor between the point of the fault and the source

I_a is the current causing the automatic operation of the disconnecting protective device within a conventional time not exceeding five seconds

U_0 is the nominal AC RMS voltage to earth

If a fault occurs close to the UPS (before the power distribution) while the UPS system is in Battery Operation and Bypass is unavailable, the available power is unable to activate the protective device. In that situation the Inverter will shut down in five seconds (IEC 60364-4-41 413.1.3.5 norm). If a residual current protective device is used, this device will disconnect the supply.

The four diagrams show the Symmetra MW installed in four different TN systems:

- Earthing arrangements and protective conductors - Symmetra® MW in “TN-S installation”
- Earthing arrangements and protective conductors - Symmetra® MW in “TN-S installation” (Legal in DK - special cases)
- Earthing arrangements and protective conductors - Symmetra® MW in “TN-C-S installation”
- Earthing arrangements and protective conductors - Symmetra® MW in “TN-C installation”

TT Systems

Characteristics

TT systems have one point connected directly to ground and all exposed conductive parts of the installation must be connected to an earth electrode. This earth electrode is independent of the power system earthed point.

Reference to IEC 60364-4-41 413.1.4

All exposed conductive parts that are protected collectively by the same protective device must be connected to a common earth electrode together with the protective conductors. In installations where several protective devices are utilized in series, the requirement applies separately to all exposed conductive parts protected by each device.

The neutral point or, if a neutral point does not exist, a phase conductor of each generator station or transformer station must be earthed.

Protective devices in TT systems

The following protective devices are recognized in TT systems:

- Overcurrent protective devices
- Residual current protective devices

Overcurrent protective devices are only applicable for protection against indirect contact in TT systems where a low R_A value exists (see specification below).

The condition $R_A \times I_a \leq 50V$ must be fulfilled.

In the condition:

R_A is the sum of resistance of the earth electrode and the protective conductor for the exposed conductive parts

I_a is the current causing the automatic operation of the protective device.
When the protective device is a residual current protective device, I_a is the rated residual operating current $I_{\Delta n}$

For discrimination purposes, S-type residual current protective devices may be used in series with general type residual current protective devices. To provide discrimination with S-type residual current protective devices, an operating time not exceeding 1 second is permitted in distribution circuits.

When the protective device is an overcurrent protective device, it must be either:

- a device with inverse time characteristics and I_a must be the current causing automatic operation within 5 seconds, or
- a device with an instantaneous tripping characteristic and I_a must be the minimum current causing instantaneous tripping

The following diagram shows a Symmetra® MW installed in a TT system:

- Earthing arrangements and protective conductors - Symmetra® MW in “TT installation”

IT Systems

Characteristics

In IT systems the installation is insulated from earth or connected to earth through a sufficiently high impedance. Exposed conductive parts are earthed individually, in groups, or collectively.

Reference to IEC 60364-4-41 413.1.5

In IT systems the installation must be insulated from earth or connected to earth through a sufficiently high impedance. This connection must be made either at the neutral point of the system or at an artificial neutral point. The latter may be connected directly to earth if the resulting zero-sequence impedance is sufficiently high. In installations where no neutral point exists, a phase conductor can be connected to earth through an impedance. In case of a single fault to an exposed conductive part or to earth, the fault current will be low and disconnection will not be imperative.

Exposed conductive parts must be earthed individually, in groups or collectively and the condition $R_A \times I_d \leq 50 V$ must be fulfilled.

In the condition:

R_A is the resistance of the earth electrode for exposed conductive parts

I_d is the fault current of the first fault of negligible impedance between a phase conductor and an exposed conductive part. The I_d value takes the leakage currents and the total earthing impedance of the electrical installation into account

In systems where an IT system is used for continuity of supply, an insulation monitoring device must be provided to indicate the occurrence of a first fault from a live part to the exposed conductive parts or to the earth. It is recommended to eliminate a first fault as soon as possible.

Depending on whether all exposed conductive parts are interconnected by a protective conductor (collectively earthed) or are earthed in groups or individually, after a first fault, the disconnection conditions of the supply for a second fault must be as follows:

1. In installations where the exposed conductive parts are earthed in groups or individually, the protection conditions for TT systems apply (see 413.1.4.1)
2. In installations where the exposed conductive parts interconnected by a protective conductor collectively earthed, the conditions for TN systems apply

In installations where the neutral is not distributed, the following conditions must be fulfilled:

$$Z_s \equiv \frac{\sqrt{3} \times U_0}{2 \times I_a}$$

In installations where the neutral is distributed, the following conditions must be fulfilled:

$$Z'_s \leq \frac{U_0}{2 \times I_a}$$

In the condition:

U_0 is the nominal A_C RMS voltage between phase and neutral

Z_s is the impedance of the fault loop comprising the phase conductor and the protective conductor of the circuit

Z'_s is the impedance of the fault loop comprising the neutral conductor and the protective conductor of the circuit

I_a is the operating current of the protective device. The disconnecting time is 5 seconds (distribution circuits)

Protective devices in IT systems

The following protective devices are recognized in IT systems:

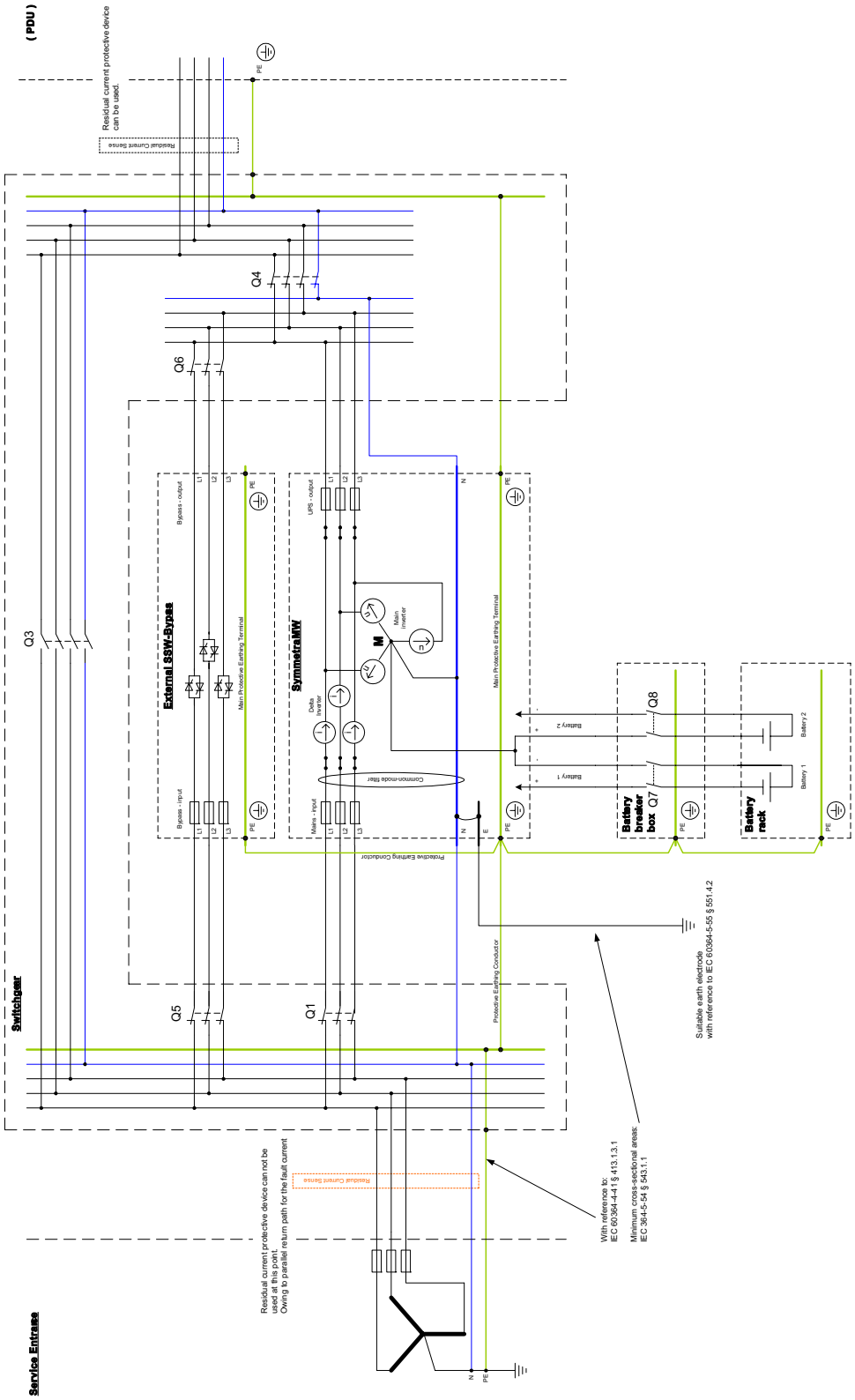
- Insulation monitoring devices
- Overcurrent protective devices
- Residual current protective devices

The following diagram shows a Symmetra® MW installed in a IT system:

- Earthing arrangements and protective conductors - Symmetra® MW in “IT installation”

Earthing arrangements and protective conductors - Symmetra MW installation

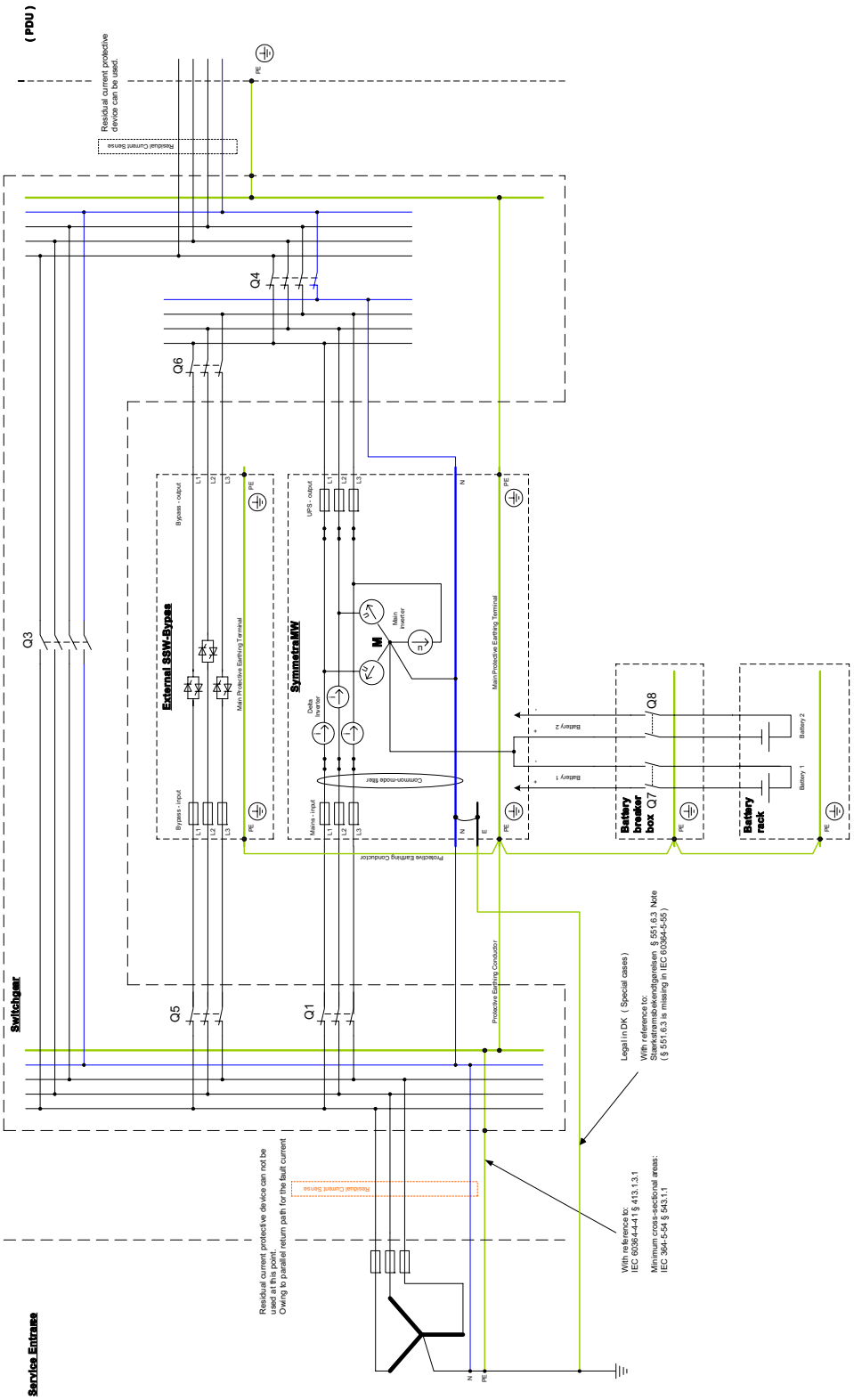
See: IEC 60364-4-41 § 413.1.3



Earthing arrangements and protective conductors - Symmetra MW in TN installation"

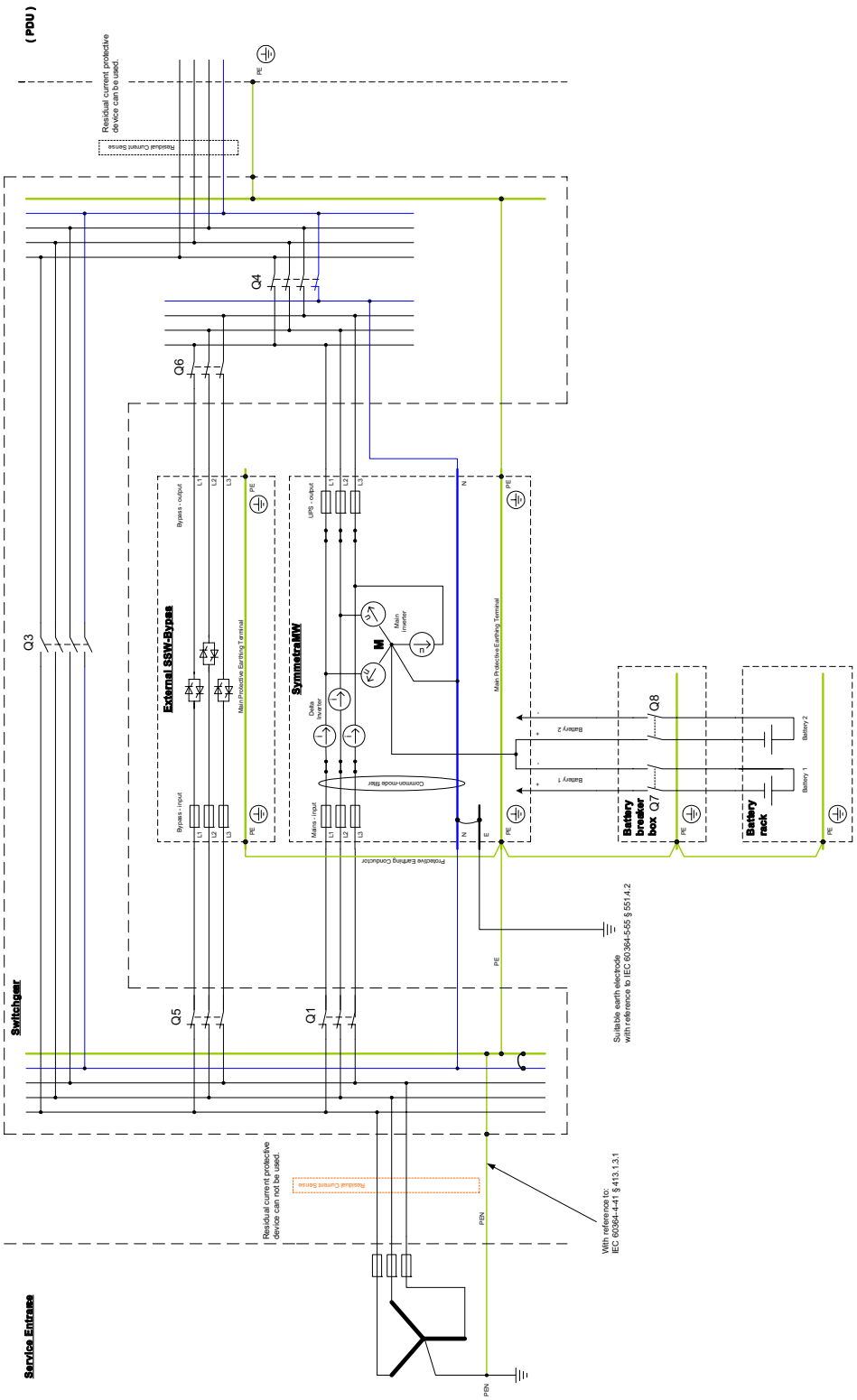
(Legal in DK - special cases)

See: IEC 60364-4-41 § 413.1.4 and "Stærkstrømsbekendtgørelsen" § 551.6.3. Note



Earthing arrangements and protective conductors - Symmetra MW in "TN-S" installation

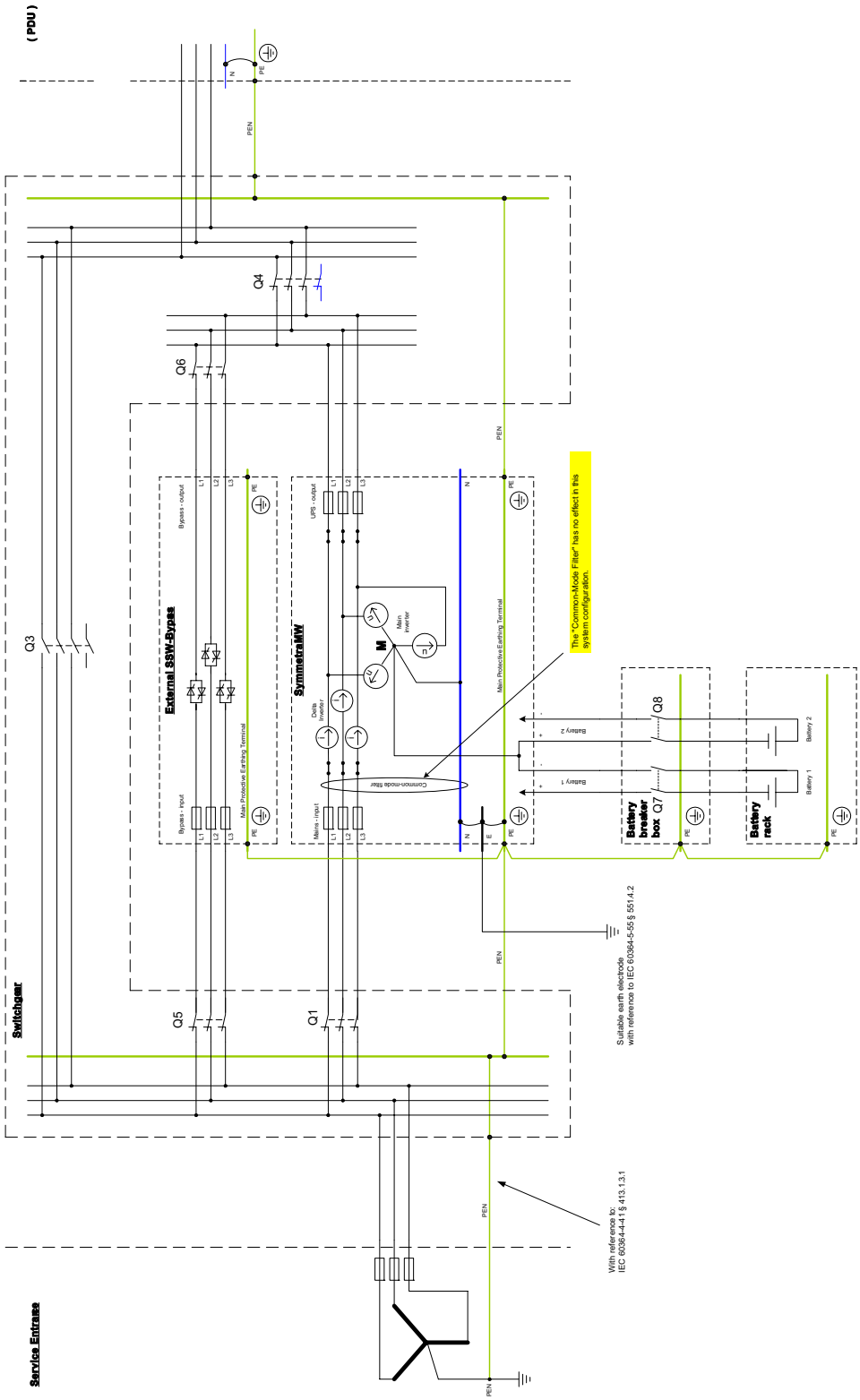
See: IEC 60364-4-41 § 413.1.3



Earthing arrangements and protective conductors - Symmetra MW in TN installation

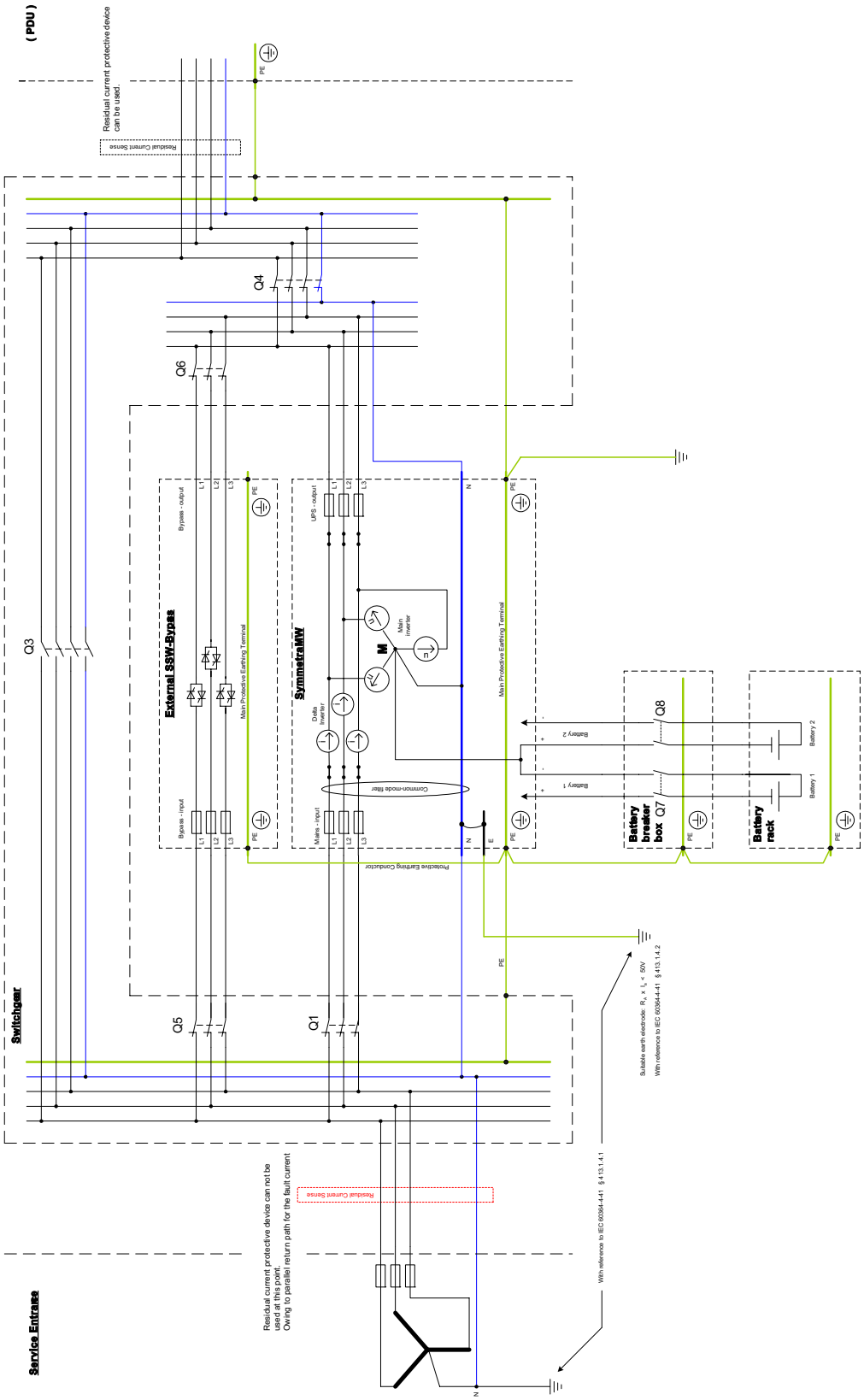
See: IEC 60364-4-41 § 413.1.3

This system configuration is not recommended



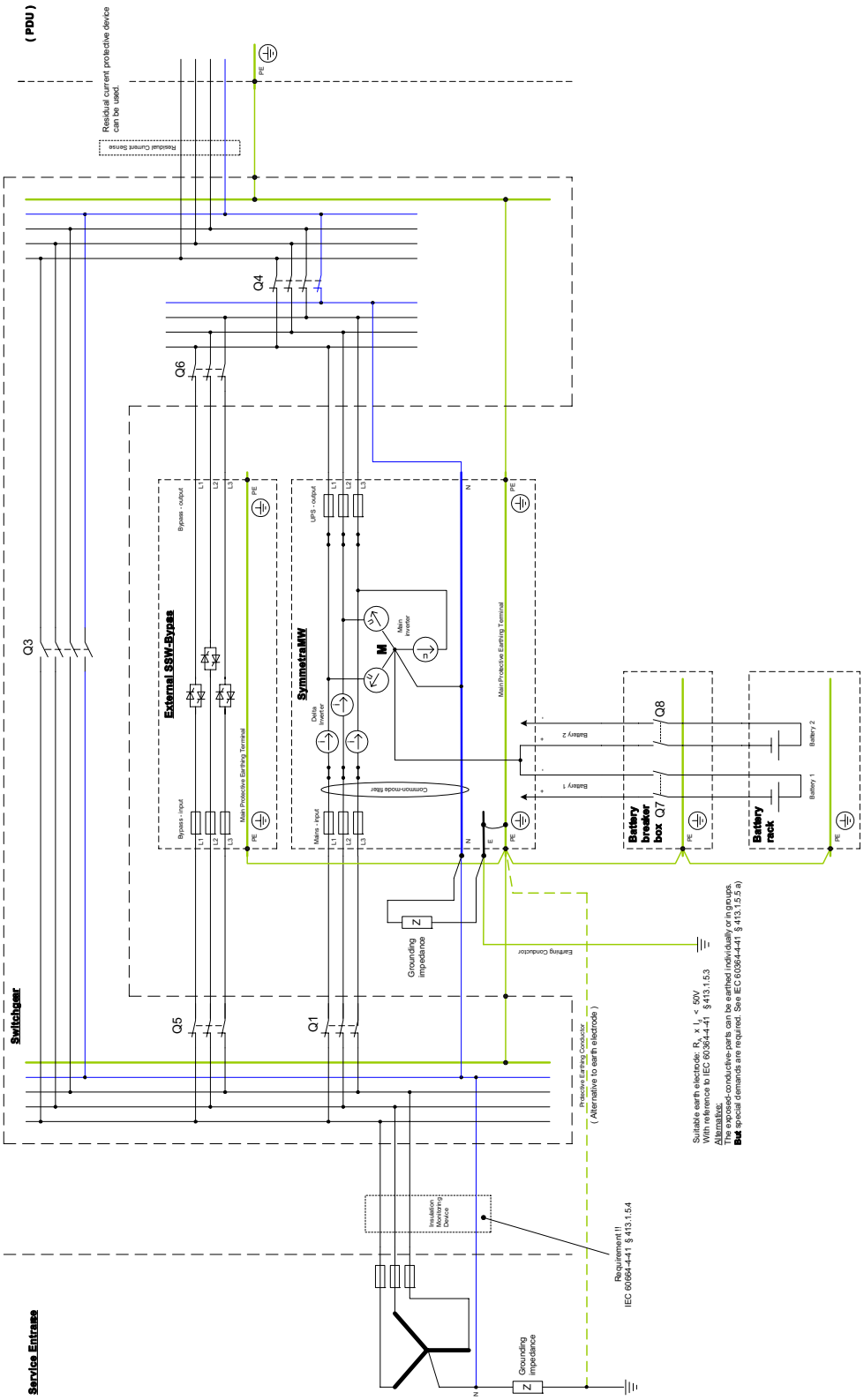
Earthing arrangements and protective conductors - Symmetra MW Installation

See: IEC 60364-4-41 § 413.1.4



Earthing arrangements and protective conductors - Symmetra MW in "IT installation"

See: IEC 60364-4-41 § 413.1.5



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990-1979E-001

4/2009